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Enhancing Nutritional Learning Outcomes Within a Simulation and Pervasive Game-Based Strategy

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Abstract: Games are often seen as a means of enhancing motivation in learning. Despite the rhetoric, however, games that provide quality experiences for learners are hard to find. One reasoning is the focus on the game medium without a clear understanding of the strategy behind it. This paper outlines a game designed to raise primary school-aged children's awareness of nutritional issues using simulation and pervasive gaming strategies. Nute implements ubiquitous mobile technology and QR Code scanning to allow players to engage in virtual shopping. The effects of their dietary choices are manifest in a simulated character, Nute, who has similar dietary requirements to the target audience. By making conscious decisions about nutrition, seeing the effects and developing strategies to maintain the wellbeing of Nute, it is proposed that simulation and pervasive game strategies are ideal tools for learning approaches to promote active choice and real world learning transfer.

Introduction

The value of games as learning tools is one that is receiving increasing attention. One of the driving forces behind this growth has been their capacity to engage learners in ways that are often seen as more inherently rewarding than traditional educational experiences (Prensky, 2006). Despite the rhetoric of games-based learning evangelists, however, there are still questions that need to be answered regarding whether learners can actually use the knowledge they acquire in games and apply it to real-world tasks (Bang, Gustafsson & Katzeff, 2007). Quality games designed specifically to promote learning are hard to find. Moreover, traditional interactive games seem to result in shallow learning. The frequent approaches of either grafting game elements onto eLearning (the 'chocolate covered broccoli' model) or repurposing commercial games for education both tend to create impoverished applications that are either fun or effective learning, but rarely both.

The goal of any instructional system is to promote learning (Ally, 2004) and increasingly, organisations are adopting are using digital technologies as the main delivery method to train employees (Simmons, 2002) There is an ongoing debate as to whether it is the design of the instruction or the use of a particular delivery technology that improves learning (Clark, 2001; Kozma, 2001, cited in Ally, 2004)

It has long been accepted that specialised delivery technologies can provide efficient and timely access to learning materials (Ally, 2004) but Clark (1983) claims that technologies are merely vehicles that deliver instruction, but do not in themselves influence student achievement, meta-analysis studies on media research have shown that:

> "Students gain significant learning benefits when learning from audio visual or computer media, as opposed to conventional instruction; however, the same studies suggest that the reason for those benefits is not the medium of instruction but the instructional strategies built into the learning materials" (Clark, 1983)

Two such strategies that can be used to enhance the development of applied skills are simulations and pervasive games. Simulations provide a virtual representation of a real world system with the goal being to develop knowledge that can be transferred from the representation to the real world (McHaney, 1991; Towne, 1995). For a simulation to be successful it must effectively model the real world task (A.L. Alexander, Brunye, Sidman, & Weil, 2005). The assumption is that a faithful representation should enhance the link between the virtual and real environments.

Pervasive games go further in that they actually bring the real world into the environment itself. Using ubiquitous technologies they are able to integrate the physical and social aspects of the real world, instantiated in forms such as Smart Toys and Affective Gaming, as well as Location Aware and Augmented Reality Games (Magerkurth et al., 2005). Common to all of these is a sense of immediate real world feedback, engagement in the social aspects of an environment and a heightened sense of agency.

This paper describes the design of a game to raise nutritional awareness within primary school-aged children. The game uses a blend of simulated and pervasive elements using ubiquitous technologies to enhance children's capacity to make informed choices with regard to their own eating habits.

Background

Australian and international evidence confirms that the early years of a child's life are critical to his or her future development. It is at this time that a child's brain is rapidly developing and the foundations for learning, behaviour and health over the life course are set (FaHCSIA, 2010). While the National Nutrition Survey (NNS) was conducted in 1995 and the last National Physical Activity Survey was in 1985, the

intervening decades have seen substantial changes in the Australian physical exercise, food supply and eating habits. These include an increase in technologies that facilitate sedentary behaviour (e.g. video games and mobile phones) and changing family life and structure (e.g. increased participation of both primary and secondary care-givers in the workforce). All of these factors are likely to impact on what children eat and what they do. Indeed, the prevalence of overweight and obesity has rapidly increased since the mid-1980s. State-based surveys indicated that currently 5% of Australian children are obese and a further 20% are overweight using internationally agreed criteria. National-level data on children's intake and energy expenditure are needed for monitoring and understanding weight status and to assess the adequacy of children's diets and activity patterns.(DoHA, 2007)

Effective health communication to young people should be based on a sound understanding of their perceptions of healthy and unhealthy eating habits, their perceptions of the various socialising agents and other sources communicating healthy eating habits to them, and their perceptions of different communication appeals regarding healthy eating.

Scholars generally agree that healthy eating habits are developed through a process of socialisation, in which families, schools, the community, the government and international health organizations may all play an active role (Kelly et al., 2006; McGinnis et al., 2006; Raiha et al., 2006). Parents serve as role models and influence adolescents' purchase behaviour directly (McNeal and Ji, 1999). Empirical data supports the notion that parental support for healthy meals and nutrition skills has a positive association with adolescents' healthy food choices and healthy eating habits (Raiha et al., 2006; Young and Fors, 2001). Schools also disseminate nutrition and health information through the formal curriculum as well as extracurricular activities. Schools can support healthy eating by monitoring the nutrition values of the food supplied in lunches and snack shops (Nutbeam, 2000). Interestingly, however, peers have been shown to have a negative influence on healthy eating (Kelly et al., 2006). Conflict between parental influence and peer influence may prompt young consumers to refuse to bring healthy food to school when their friends buy or consume food and beverages that are high in calories and low in nutrients (these foods are sometimes termed "junk" foods). Peer influence on body weight and body image also triggers unhealthy dieting practices such as vomiting or using laxatives for weight control (McGinnis et al., 2006).

Nute: A Serious Game to Promote Healthy Eating.

Given the diversity of social influences on children it is important that intervention activities should provide the impetus for the sharing and negotiation of understandings at all levels of a child's sphere of influence. The program needed to be developed in such a way that it could be implemented in both formal and informal settings such school and home, and promote meaningful discussion about nutritional choice. Accessibility was another key factor. With many 'tweens' now being able to access affordable mobile game technologies in the form of smart phones, and the increase in the casual game market afforded by such devices, there is a real potential for games to be a part of children's ongoing digital lifestyle.

Nute is a project currently being undertaken at Edith Cowan University in Australia to explore the potential of a casual game can be used to help parents and children understand the different nutritional values of the food they eat. The game contains both pervasive and simulation elements. The pervasive nature of the game is evident in the use of mobile phones to scan nutrition labels as part of a shopping activity. This shopping is then brought into a simulation game that allows learners to explore the effects of their decisions on a virtual pet ('Nute') and then identify strategies to address shortfalls in that decision-making.

Pervasive Gaming – Going Shopping.

QR Codes are digital representations of information as a pixelated graphic. Most converged mobile devices can use their camera facility to take a picture of the code with is then translated into meaningful information through 'app' software. QR codes can be used as digital business cards or provide information relating to buses at stops and so on. In this case, the information is a link that will update an online database using PHP/MySQL (Figure 1). Where QR Codes are presented inline with shopping items such as in pricing information in a supermarket, scanning a code has the potential to update a shopping cart of food items.

Figure 1: Scanning QR Codes to update an online shopping cart

In this case the database contains information not only about the food item itself but also about the nutritional information drawn from a freely available Australian nutritional database. The purpose is for

children to conduct a weekly 'shop' for a virtual character (Nute), who has remarkably similar dietary needs to themselves. The shopping activity is designed in such a way that it could be conducted in a classroom setting by pasting food 'Flash Cards' around a classroom attached to QR Codes. The ideal would be to work with a food retailer to incorporate such information into their pricing and barcode systems so the activity could be performed in real life as they undertake the weekly shop with their parents.

Simulation Activity – Caring for Nute.

Once the shop has been completed the next stage is to 'feed' Nute. This means applying the contents of the shopping cart to the Nute character, and, using animation, to witness the effects of their shopping on Nute's wellbeing.

Care was taken in the design of Nute to create a character that would appeal to children of the target age group. Several conceptual designs were proposed by a group of undergraduate students who were undertaking development of the game as part of project work in ECU's Digital Media and Game Design & Culture courses. The brief they were given was that Nute needed to be a character with whom children could identify but would not be so realistic a representation that it could be seen as impacting on self-esteem or having pejorative overtones. It was for this reason that the working title of the character 'Blobagotchi' was changed to Nute. It was important therefore to strike a careful balance in terms of the level of abstraction of the character.

Focus groups consisting of a small cohort of appropriately aged children (the investigator's children and their peers) as well as an expert review panel consisting of design students undertaking a unit of study in creativity were used to identify the strengths and weaknesses of each concept. In both groups there was a clear differentiation in attitude to each design. The design represented in Figure 2 was identified as being 'too' human. In the expert group the style was described as overly familiar and reminiscent of existing public health strategies. One person noted the phallic depiction of the character. For the target group, the approach wasn't 'fun' enough. Figure 3 received a warmer response from some groups and was the initial choice of the authors of this paper. In many respects it was the one that most closely represented the brief. The ease with which the character could be animated was also considered a benefit. The majority of both groups however assessed Figure 4 as the best character. The target group was unanimous in its opinion that it was the preferred depiction of Nute. It was seen as having the most personality and the target group felt an immediate sense of identification with it.

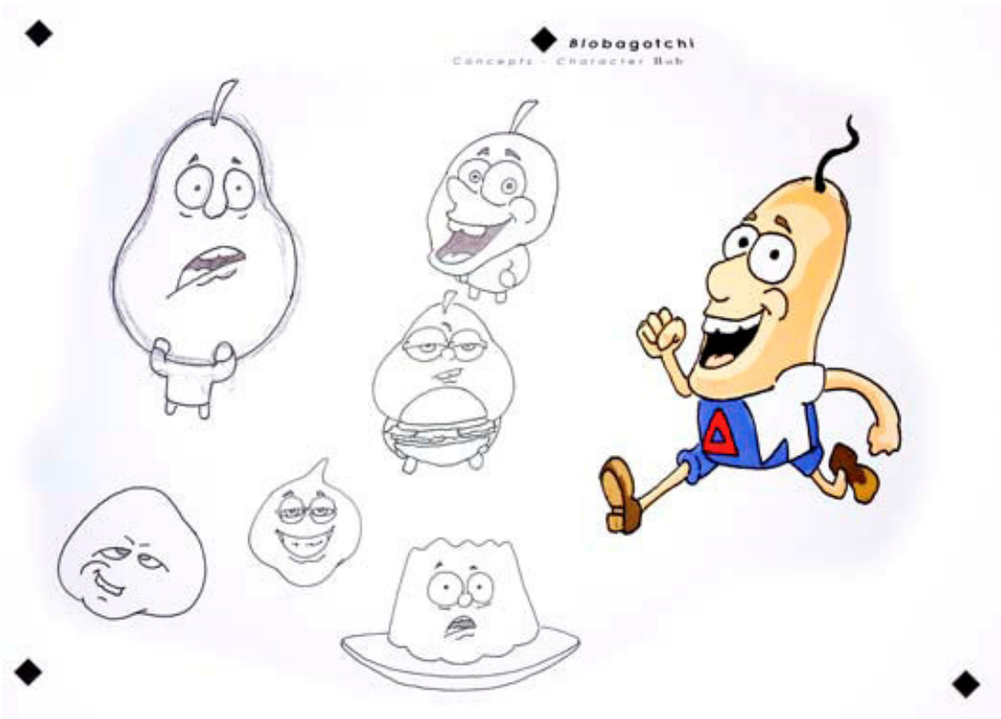

Figure 2: Nute - Concept 1

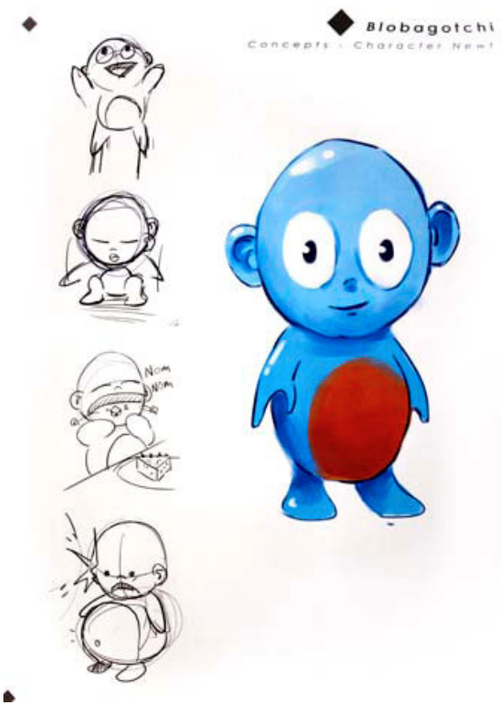

Figure 3: Nute - Concept 2

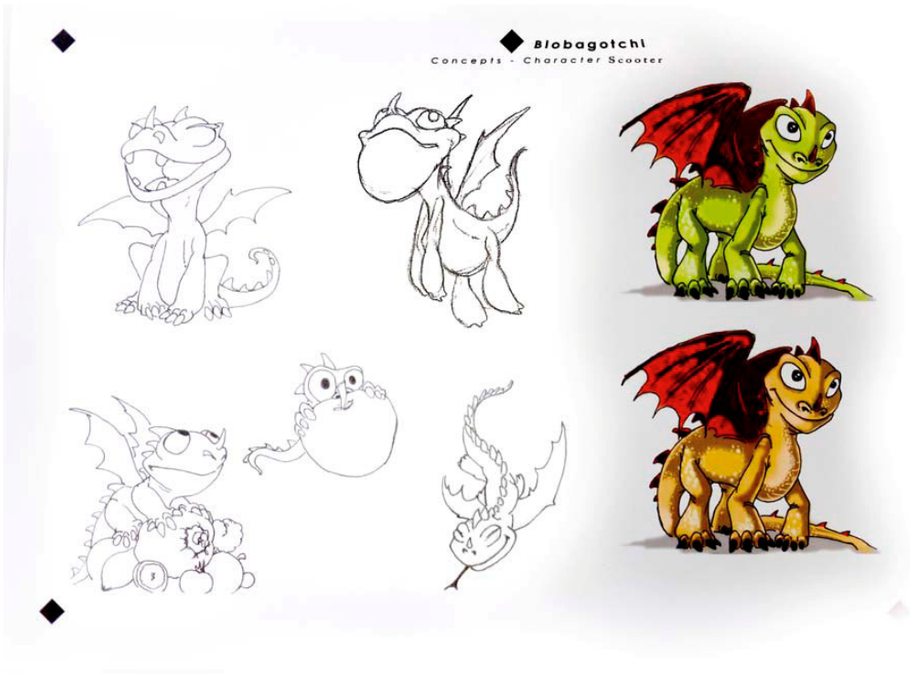

Figure 4: Nute - Concept 3

There are inherent issues in the representation of Nute as a dragon. Such a design could prove difficult to animate and the level of abstraction meant that a stronger case would need to be built within the game narrative to enforce Nute's dietary requirements as being similar to those of the target audience. Nevertheless the development team felt capable of being to address these issues in the game design and development.

Following initial conceptual design, the next stage was to create a narrative to introduce the character and the activity. The fictionalized setting was decided to be a typical family home with a child who is visited by Nute and charged through a letter taped to his collar to look after the character, feeding and caring for it as they would any other child of their age.

Once learners have completed the shopping activity and Nute has eaten the effects of the diet are available via a written report relating to the amounts of fat, carbohydrates, protein and energy consumed and represented within Nute him/herself. A matrix has been developed that has synthesized the nutritional information into representations of bloatedness, listlessness, weakness etc. If the overall dietary intake has been inadequate, learners are advised to go shopping for Nute again. If the intake is excessive, learners have the opportunity to work off the extra nutrition in the form of exercise activity (Figure 5). In all cases, the learners receive feedback about the effect of their decision-making and the need to achieve balance in making nutritional decisions.

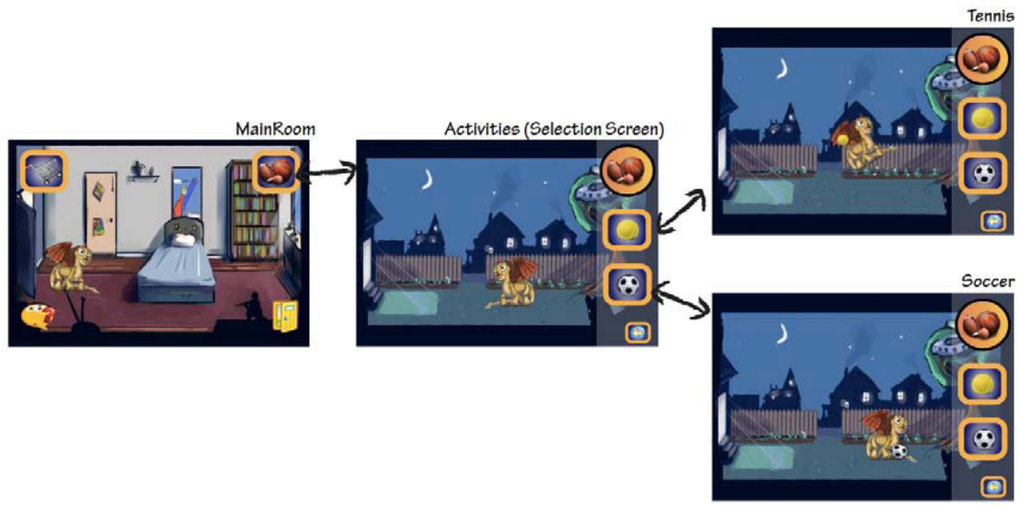

Figure 5: Addressing Nute's wellbeing through physical activity

Conclusions

The experiential value of games is a frequently argued as a powerful method of engaging learners, however the lack of examples of games that demonstrate both a strong sense of agency and the potential to be effective learning tools suggests that the potential of serious games is yet to be fully realized. Effective learning is often associated with a change in both attitude and behavior where skills can be readily applied in the real world and where the learning is grounded in social activity, producing a strong level of agency.

Pervasive games and simulations have the capacity to model real life activity within a games-based environment as well as bring the game out into the real world itself. Nute is an example of one such game that uses ubiquitous mobile technologies as a real world platform while engaging learners in simulated play through the care of a fictional character. Using QR codes to scan food items and witnessing the nutritional effects of these items on Nute has the potential to engage learners in a rich and playful environment that can lead to real world change. By the time of publication, a research prototype of Nute will have been developed and some initial findings as to its effectiveness will be able to be presented.

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